

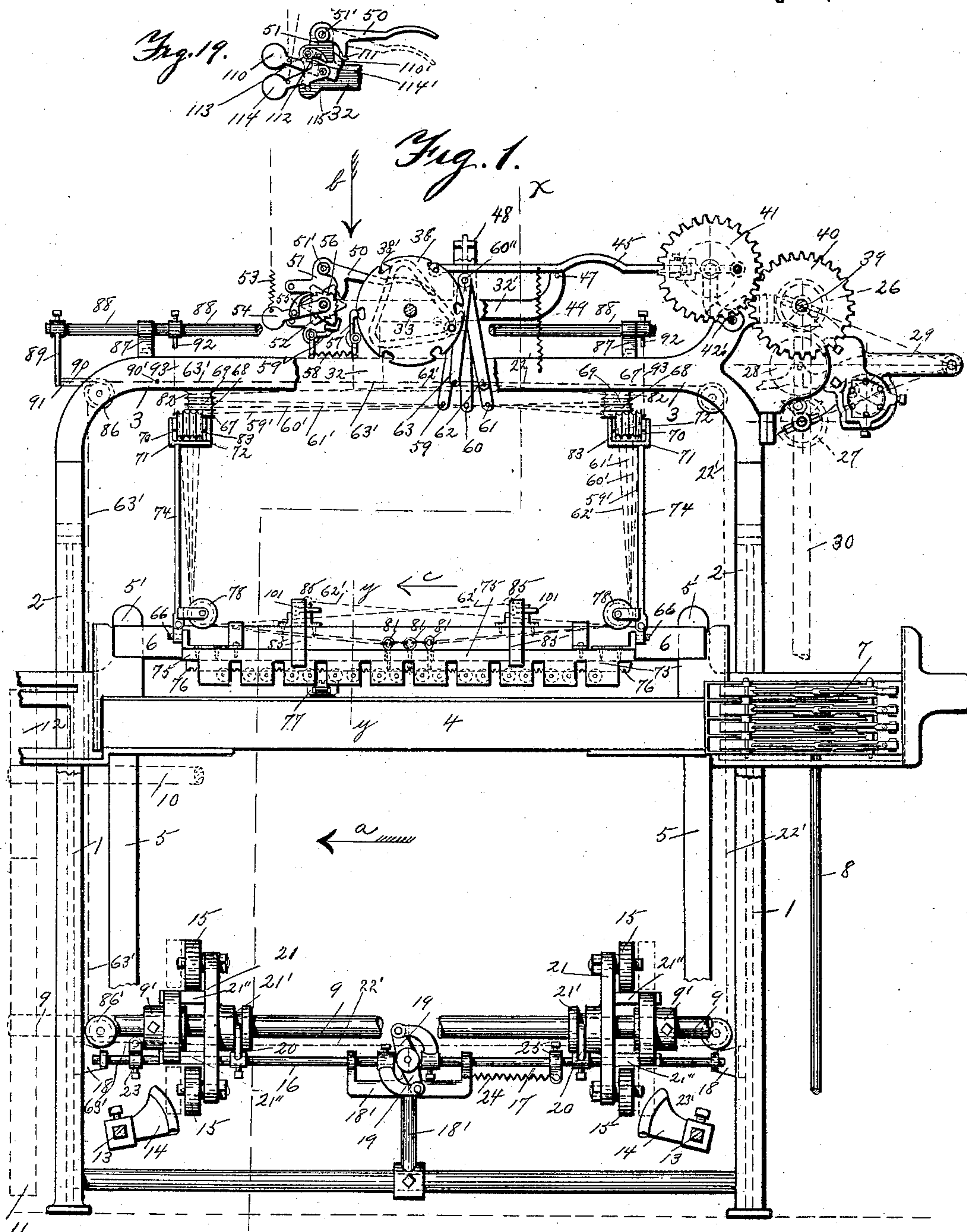
(No Model.)

5 Sheets—Sheet 1.

G. F. HUTCHINS.  
SWIVEL LOOM.

No. 474,170.

Patented May 3, 1892.



Witnesses

X

Joseph T. Cyr.

Chas. T. Fletcher.

Inventor

George F. Hutchins

By his Attorney

John C. Dewey

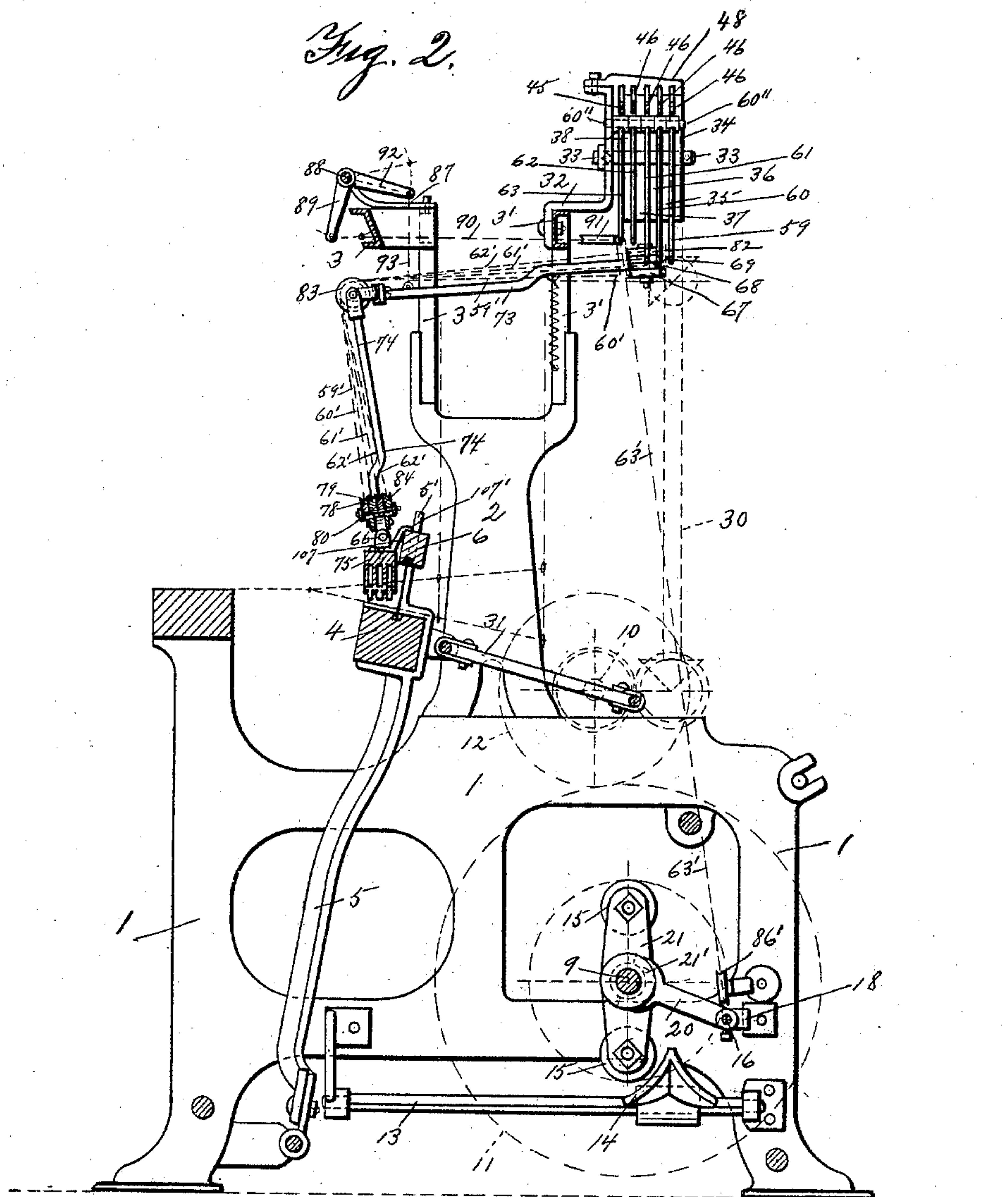
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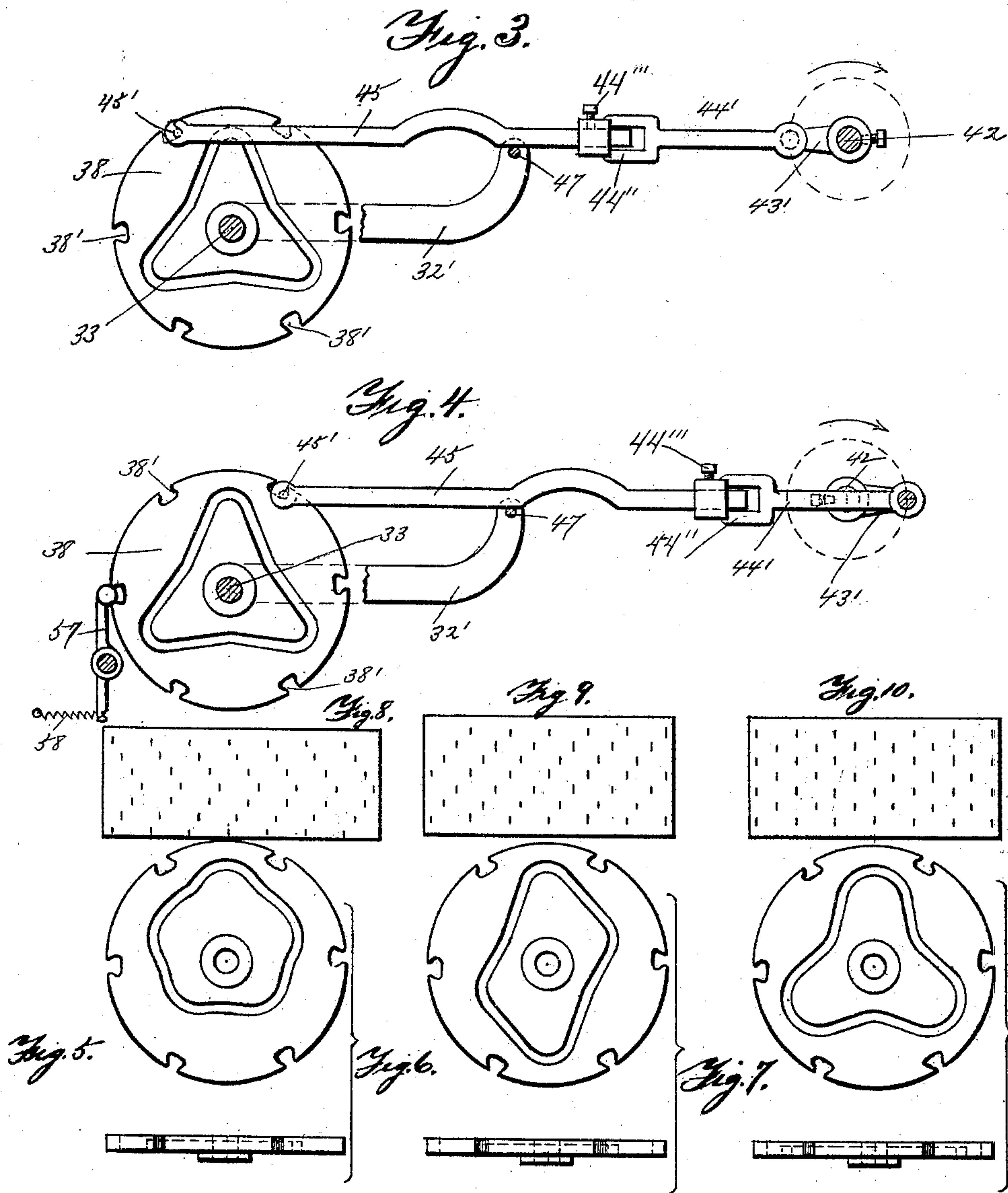
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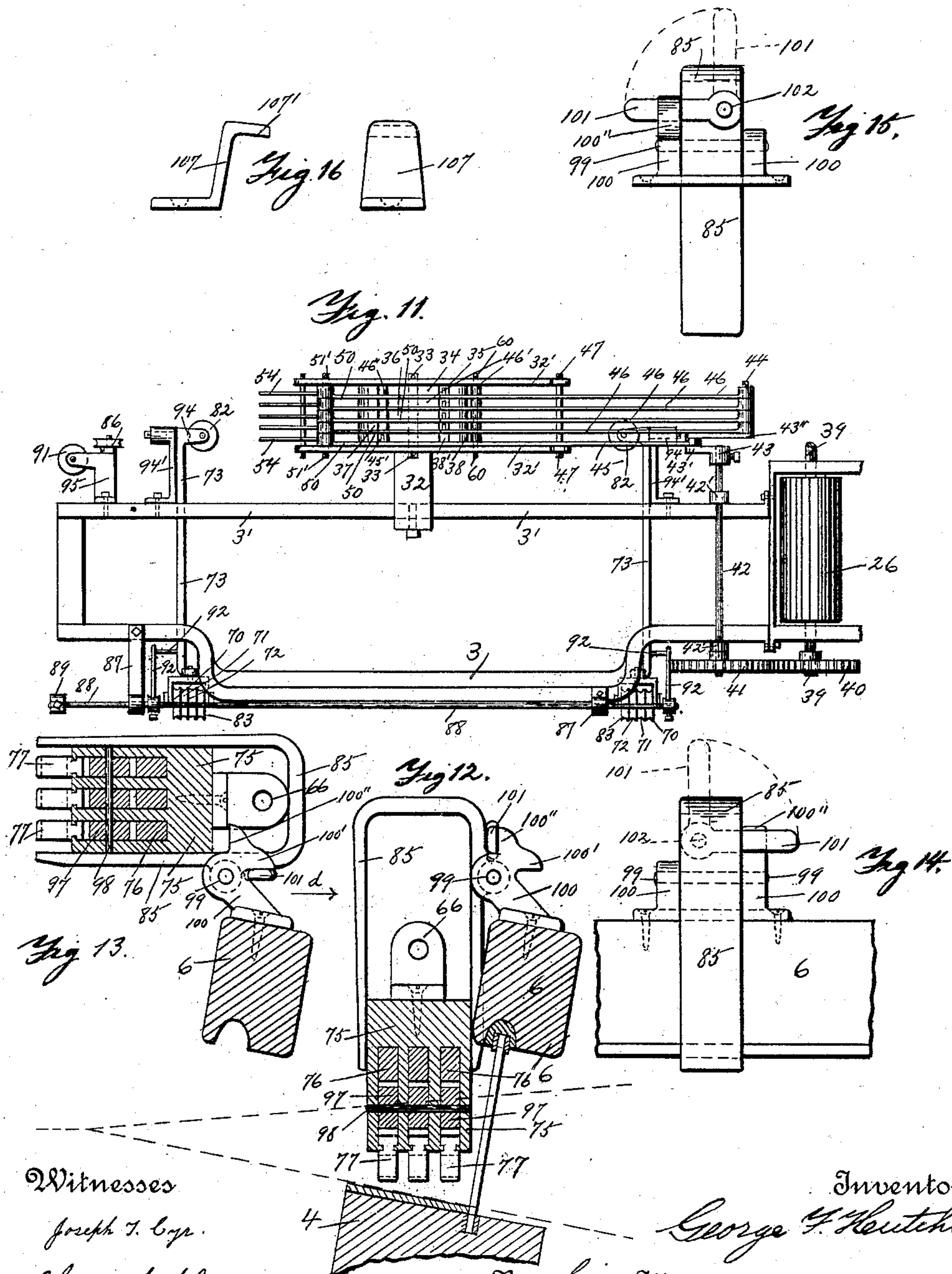
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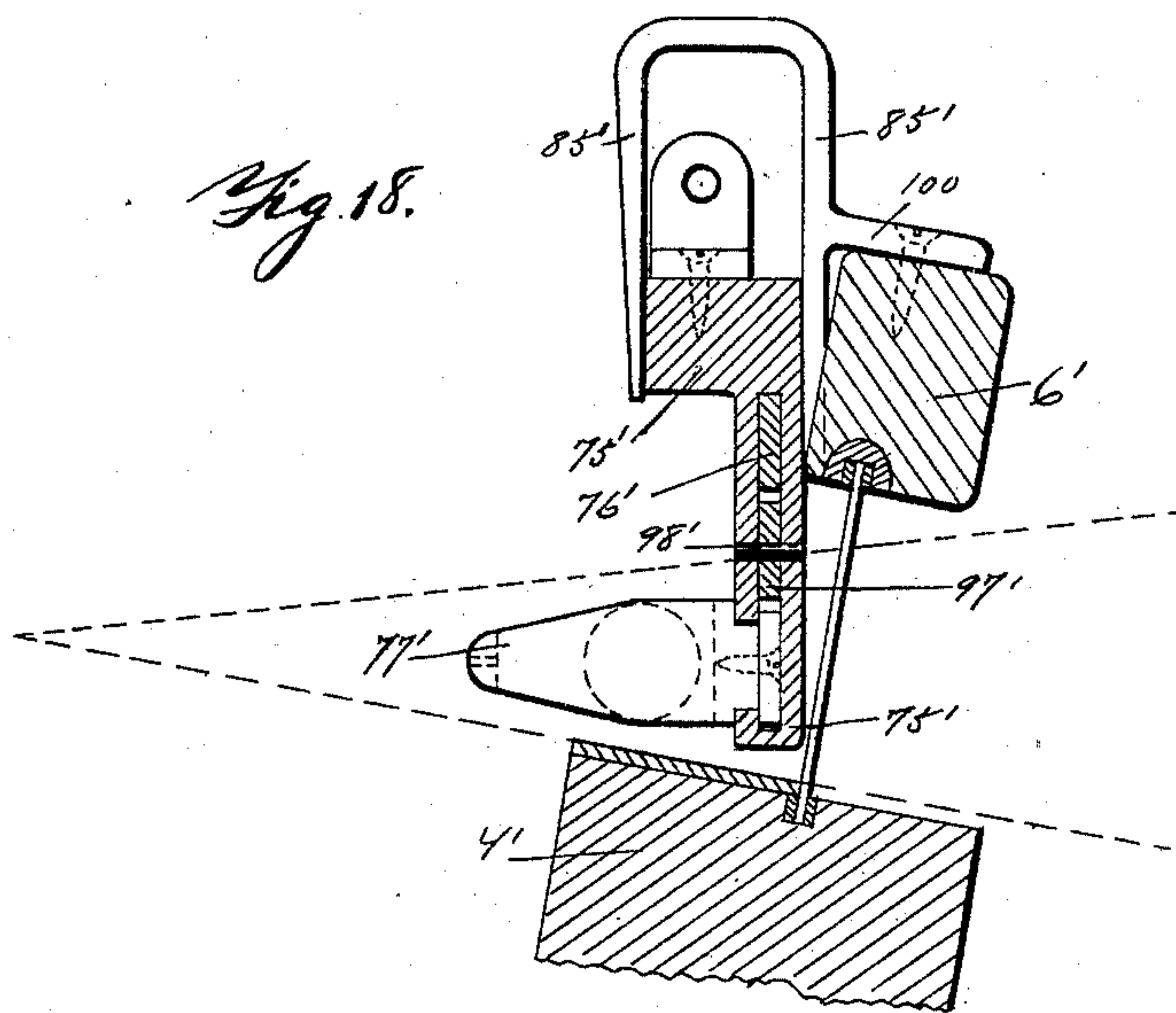
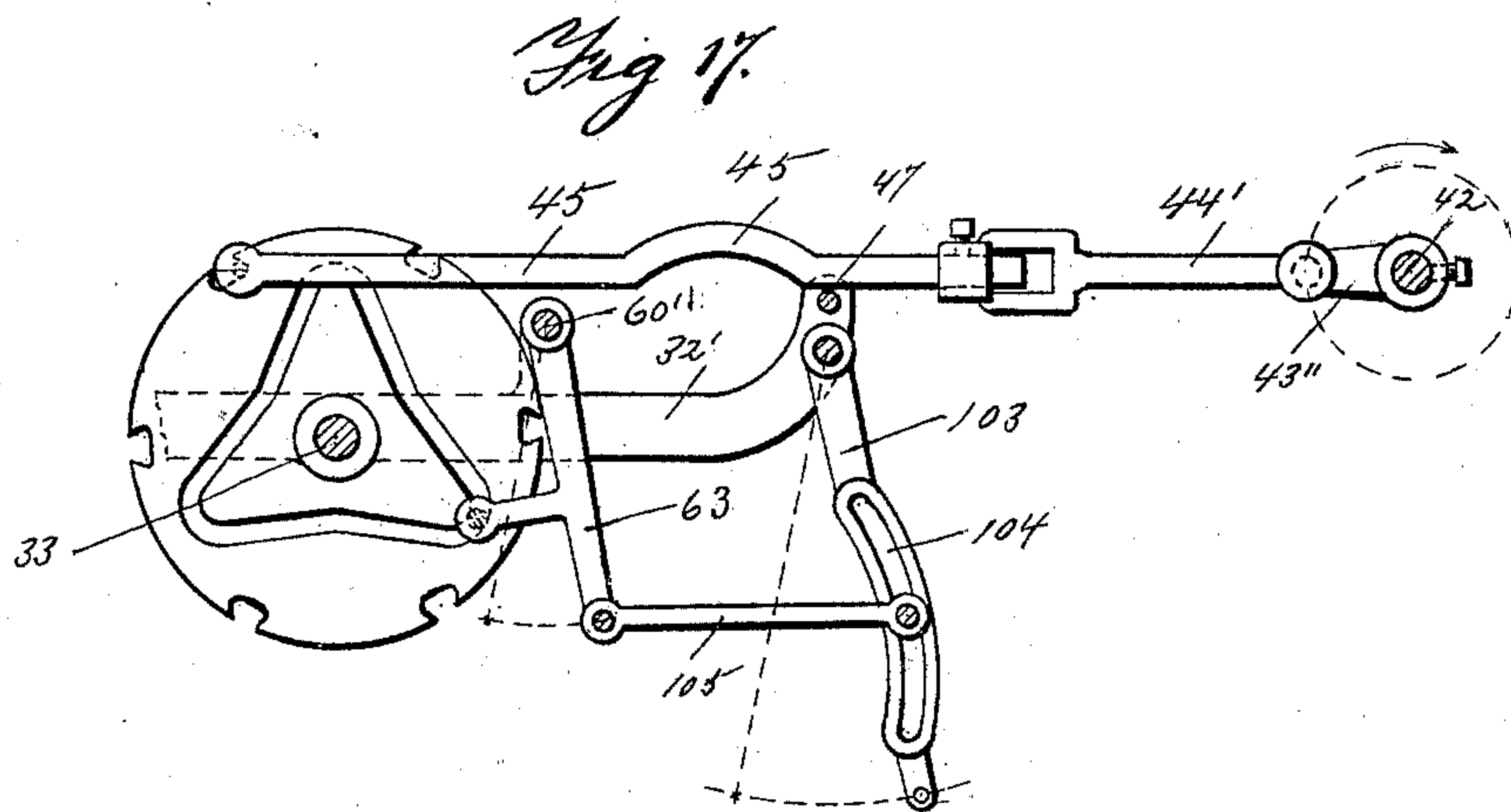
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# UNITED STATES PATENT OFFICE.

GEORGE F. HUTCHINS, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO THE  
KNOWLES LOOM WORKS, OF SAME PLACE.

## SWIVEL-LOOM.

SPECIFICATION forming part of Letters Patent No. 474,170, dated May 3, 1892.

Application filed March 23, 1891. Serial No. 386,169. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE F. HUTCHINS, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Swivel-Looms; and I do hereby declare that the following is a full, clear, and exact description thereof, which, in connection with the drawings making a part of this specification, will enable others skilled in the art to which my invention belongs to make and use the same.

My invention relates to looms, and more particularly to swivel-loom— that is, to those looms in which, in addition to the ordinary fly-shuttle, swivel-shuttles are used for the purpose of making spots or figures in the fabric.

The object of my invention is to provide a swivel-shuttle mechanism adapted to be applied to the ordinary form of fly-shuttle loom, and which will automatically weave spots or figures in the fabric produced in the loom, each spot or figure having one or more colors of weft therein, as desired.

My invention consists in certain novel features of construction and certain novel and improved combinations of parts, all as will be hereinafter fully described with reference to the accompanying drawings, and then distinctly defined and particularly pointed out in the claims.

My improvements may be applied to any of the ordinary forms of fly-shuttle looms and may co-operate therein with the usual operating mechanism of such looms.

I have shown in the drawings my improvements applied to the well-known Knowles loom, the construction and operation of the characteristic features of this loom being fully set forth in Letters Patent of the United States No. 134,992.

I have shown in the drawings only such parts of a Knowles loom having my improvements applied thereto as is sufficient to clearly illustrate the application and relations of my improvements.

Referring to the drawings, Figure 1 is a front elevation of portions of a loom of the class referred to, provided with my improved swivel-shuttle mechanism, parts of the said mechanism and of the loom-frame being

broken away. Fig. 2 is a sectional elevation taken on line  $xx$ , Fig. 1, looking in the direction of arrow  $a$ , same figure. Fig. 3 is a detail view of a part of the swivel-shuttle-weaving attachment, the said figure showing one of the cams hereinafter referred to, the pawl for actuating the same, the pawl-operating crank, and the support on which the pawl slides. Fig. 4 is a view similar to Fig. 3, but shows the pawl in the position thereof which is the opposite of that shown in Fig. 3, said figure also showing a lock-lever for the cam. Figs. 5, 6, and 7 are side and plan views of cams for changing the position of the swivel-shuttle rail laterally in the loom, so that the spots produced shall be arranged in the positions shown in Figs. 8, 9, and 10, respectively. Fig. 11 is a plan view of the upper part of the loom shown in Fig. 1 looking in the direction of arrow  $b$ , same figure, some of the parts being left off. Fig. 12 represents, on an enlarged scale, a section on line  $yy$ , Fig. 1, looking in the direction of the arrow  $c$  in the same figure, it showing the manner in which the movable swivel-shuttle rail may be mounted on the hand-rail of the loom and locked in position thereon, the swivel-shuttle rail being down in working position. Fig. 13 is a view corresponding to Fig. 12, but showing the movable swivel-shuttle rail locked in its upper position. Fig. 14 is a front view in detail of the hand-rail and guiding and locking devices for the swivel-shuttle rail, (not shown,) looking in the direction of arrow  $d$ , Fig. 12. Fig. 15 is a rear view of the devices shown in Fig. 14. Fig. 16 shows in side view and also front view the arm, which may be made fast on the top of the movable swivel-shuttle rail and arranged to come into contact with and rest on the hand-rail, as shown in Fig. 2, to act as a stop in limiting the downward movement of the said swivel-shuttle rail. Fig. 17 is a view showing a modification of the mechanisms shown in Figs. 3 and 4 for shifting the swivel-shuttle rail laterally in the loom. Fig. 18 is a view showing a modification having one set of swivel-shuttles, which are placed in a horizontal position in the ordinary way, instead of in a vertical position; and Fig. 19 is a view showing a modification of the indicating mechanism shown in Fig. 1. Figs 3 to



18, inclusive, except Fig. 11, are on a larger scale than the other figures.

In the accompanying drawings, 1 are the loom sides; 2, the arch-stands; 3, the front arch; 3', the back arch; 4, the lay; 5, the lay-swords; 5', the lay-sword horns, to which is bolted the hand-rail 6; 7, one set of fly-shuttle boxes, the other set not being shown; 8, the lifting-rod pertaining to the shuttle-boxes 7; 9, the bottom shaft of the loom, and 10 the crank-shaft. 11 and 12 are gears whereby said shafts are geared together, and 13 13 are the picking-shafts, which extend at right angles to the bottom shaft 9 and carry the picking-shoes 14, the latter being operated upon by the rolls 15, carried by the arms or castings 21 on the bottom shaft 9 in the ordinary way.

Adjacent to the bottom shaft 9 is arranged the shipping mechanism for controlling the action of the fly-shuttle-operating mechanism. This shipping mechanism may be of any desired or known construction.

In the drawings I have shown devices for moving the picking-rolls 15 into and out of engagement with the picking-shoes 14, as shown by full and dotted lines, Fig. 1, the said devices consisting of sliding rods 16 and 17, supported and sliding in stands 18 and 18', with their inner ends connected by curved arms 19' to a lever 19, pivoted on the central stand 18'. In consequence of being connected by the said arms 19' to the opposite arms of the lever 19, the said sliding rods, when they are actuated in a manner to move them endwise, are caused to slide simultaneously in opposite directions. Thus, the parts being in the position in which they are represented in Fig. 1, if rod 16 is drawn to the left—that is, away from the middle of the loom—the rod 17 will be moved toward the right—that is, also, away from the middle of the loom. In like manner, whenever either of the said rods is moved toward the middle of the loom the other thereof, also, will be moved simultaneously therewith in the opposite direction—that is, also, toward the middle of the loom. The said rods 16 and 17 carry forked arms 20, each of the said forked arms being adapted to engage with the grooved hub 21' of one of the castings 21, carrying the rolls 15, said castings 21 being supported on the bottom shaft, so as to slide thereon and revolve therewith, and being provided with projecting pins 21<sup>2</sup>, which slide freely in corresponding channels in the hubs 9', fast on the bottom shaft 9. The sliding rods 16 and 17 are operated to move them outwardly from the middle of the loom, and thereby carry the picking-rolls 15 into position for coming in contact with the picking-shoes 14 by means of a cord or chain 63', to be hereinafter described, secured to a collar 23, fast on the sliding rod 16. (See Fig. 1.) The operation of said cord is controlled by a cam forming a part of my improvements, to be hereinafter described. In the present instance the picking-rolls 15 are moved out

of engagement with the picking-shoes 14 by means of a spring 24, fast at one end to the central stand 18' and at the other end to a collar 25, fast on the sliding rod 17. When the cam which moves the lever to which the cord 63' is connected permits the spring 24 to act, the said spring operates to move the rods 16 17 inwardly toward the middle of the loom, thereby carrying the rolls 15 into the position in which they are represented in Fig. 1. If desired, the picking-rolls 15 may be given a positive motion in the direction to carry them out of engagement with the picking-shoes by means of a second cord or chain 22', (see full lines, Fig. 1,) corresponding to cord 63', secured to the collar 23 on the sliding rod 16 and operated from the same lever which operates the cord or chain 63', to be hereinafter described.

The head of the loom is of the ordinary construction and operation, and consists of the upper cylinder-gear 26, the lower cylinder-gear 27, vibrator-gears 28, vibrator-levers 29, a system of gears at the upper end of the upright shaft 30 (shown in dotted lines in Fig. 1) for operating the cylinder-gears, and a system of gears at the lower end of said shaft 30 (shown by dotted lines in Fig. 2) for operating said upright shaft 30, the last-mentioned system of gears being driven by the crank-shaft 10 in the ordinary way. Crank-connectors 31, one of which is shown in Fig. 2, connect the crank-shaft with the lay, as usual.

The foregoing parts and the usual working parts of a loom, which are not shown, are or may be constructed and operated in any desired or known manner.

I will now proceed to describe my improvements, in this instance adapted to be combined with the parts of the loom above described, so as to automatically weave spots or figures having one or more different colors therein in the fabric woven in the loom. In my improvements (shown in the drawings) three sets of swivel-shuttles are used to weave in the spots or figures in the fabric; but only one set of swivel-shuttles may be used, or more than three sets may be used with practically the same mechanism. The operating-cams and pawl connections of my swivel-shuttle mechanism are preferably located at the upper part of the loom back of the harnesses and head motion, so as not to interfere with the ordinary construction and arrangement of the same. Upon the top of the back arch 3' is bolted a stand 32, extending at the rear of the loom, upon which are supported the cams and other parts of my mechanism. A stud or shaft 33 is fast in stand 32, and on said stud are supported, to revolve loose thereon in this instance, five cams, which are used to operate the several parts of my mechanism, three of which cams 34, 35, and 36 operate through intervening connections, to be hereinafter described, the three swivel-shuttle racks 76, supported in the swivel-shuttle rail 75, to be hereinafter described, and which operate the three



sets of swivel-shuttles 77, which weave the spots or figures in the fabric. The fourth cam 37 of said five cams, through intervening connections, changes the position of the swivel-shuttle rail 75, carrying the swivel-shuttle racks 76 longitudinally or in the direction of the width of the fabric, so as to place the spots or figures woven in the positions shown in Figs. 8, 9, and 10 or otherwise, as described, according to the shape of said cam. The fifth cam 38, through intervening connections, operates the sliding picking devices to cause the loom to pick or to stop picking, as desired, and also at the same time raises or lowers the swivel-shuttle rail 75 to prevent the swivel-shuttles 77 from operating or to allow them to operate to weave in the spots or figures. In this instance on one end of the shaft 39 of the upper cylinder-gear 26 is fast a gear 40, which meshes with and drives a gear 41, fast on a shaft 42, supported in stands 42', bolted on the top of the loom-arches. On said shaft 42 is secured a double crank 43, (see Fig. 11,) one arm 43' of which is connected to one end of the horizontal pawl 45. The free end of said pawl 45 is provided with a pin 45', adapted to engage the notches 38' in the periphery of the cam 38 above described. The other arm 43'' of the double crank 43 is connected by means of a pin 44 with the rear ends of the four pawls 46, the free ends of said pawls being provided with pins 46', adapted to engage the notches 46'' in the peripheries of the cams 34, 35, 36, and 37, respectively. The notches in the periphery of the cams 34, 35, 36, 37, and 38 with which the pins projecting out from the free ends of the pawls 45 and 46 engage are preferably made of the shape shown in the drawings, (see Figs. 3 and 4,) each having the contracted opening at the outer end thereof. The object of making the notches in said cams, as above described, is that in case for any purpose the loom is turned backward the pawls will not be disconnected from their cams, but will push the cams back to their former positions, and thus keep all the parts in unison with each other.

In connection with the pawls 45 and 46, which operate the cams, a stationary rod or pin 47 is used, which extends at right angles to the pawls, and in this instance is supported in the upturned arms 32' of the frame 32. The rod 47 may have friction rings or washers thereon, if desired. The object of the rod 47, in connection with the cam-section of the pawls, is to operate as a fulcrum for the pawls.

I have shown in the drawings the pawls 45 and 46 provided with curved or cam portions about the middle of their length, the object of which is to reduce the upward motion of the free end of said pawls and to prevent said ends from being thrown up as much as they would be if said pawls were made straight throughout their length. I do not limit myself to the use of pawls provided with cam-surfaces. As the cranks which operate the pawls continue to revolve after each crank-

arm has reached nearly the end of its throw, as shown in Fig. 4, (carrying down the attached end or the pawl with it,) the rod 47 will act as a fulcrum and cause the pin on the free end of each of the pawls to be raised out of the notch in the corresponding cam and be disengaged therefrom. The continued revolution of the crank will push the pawl forward and the pin in the end thereof will engage another notch in the cam when the crank is in the position shown in Fig. 3. By means of the shape of the notches in the cams (which are equivalent to teeth in a ratchet-wheel) and the use of the rod 47, in connection with the cam-sections of the pawl, it will be seen that the loom can be turned backward to the extent of a partial revolution of the crank-shaft thereof and then moved forward without disconnecting the pawls from the cams which they operate. This is an important feature in looms and other machines. The pawls 45 and 46 are preferably guided through slots in a guiding-piece 48 on the upper part of stand 32. The pawls 46 and pawl 45 are preferably adjustably connected with links 44', extending from the crank-arms 43, (see Figs. 3 and 7,) so that said pawls may be lengthened or shortened slightly, if desired. Said links 44' are provided with slotted ends, and clamps 44'' thereon provided with set-screws 44'''. Into said clamps 44'' extend the rear ends of the pawls 45 and 46, which are held and adjusted therein by means of the set-screws 44'''. I have not shown in Fig. 11 the links 44', referred to above, and said links may be used or not, as preferred, in connection with the levers 45 and 46. Springs 49, attached at their upper ends to the pawls and at their lower ends to the loom-arch, are preferably employed to draw down the free ends of the pawls, so that they will engage the notches in the peripheries of the cams at the proper time.

The operation of the pawls 46 and 45, whether or not the same shall engage with and operate their respective cams, is controlled by indicating-levers 50, one for each pawl and cam. The levers 50 are pivoted at one end on a pin 51' in an upright arm 51 of the stand 32. (See Figs. 1 and 19.) The free ends of the levers 50 extend between the cams and under the free ends of the pawls 45 and 46. (See Fig. 11.) When the free ends of the levers 50 are raised up, as shown by full lines, Fig. 19, the free ends of the pawls will ride on said levers and the pins on the pawls will not engage with the notches in the cams to operate said cams. When the free ends of the levers 50 are dropped down, as shown by dotted lines, Figs. 1 and 19, the pins on the free ends of the pawls will engage with the notches in the cams and operate said cams.

I have shown in Fig. 1 one way of operating the indicating-levers 50. I use a cam-wheel 52, operated by a Jacquard cord 53, through intervening mechanism, consisting of a lever 54, carrying a pawl 55, adapted to



engage with and operate a ratchet-wheel 56, fast on the shaft of the cam-wheel 52. The Jacquard cord 53 operates the lever 54, loose on the shaft of the cam-wheel 52 and carrying the pawl 55. Said pawl 55 engages with the teeth of the ratchet-wheel 56, fast on the hub of the cam-wheel 52, and causes said cam-wheel to revolve and operate the indicating-lever 50.

10 In lieu of a cam-wheel any kind of a cam or a wheel or other mechanism which will affect the indications from Jacquard cords or harness-cords may be substituted.

I have shown in Fig. 19 a simple modified  
15 mechanism for operating the indicating-levers 50, consisting of a weighted lever 110, having a cam projection 110' thereon adapted to engage the projection 111 on the lever 50 and hold said lever in its raised position. A  
20 pawl 112, pivoted on a pin 113, engages a notch in the weighted lever 110 and holds up said weighted lever in the position shown. A second weighted lever 114 (shown in its downward position) has a cam-surface 114 there-  
25 on, which when said lever 114 is raised by the Jacquard cord will engage a pin 115 on the pawl 112 and trip said pawl and allow the weighted lever 110 to fall, disengaging the projection 110' thereon from the projection  
30 111 on the lever 50 and allowing said lever to fall, as shown by dotted lines, Fig. 19. The second weighted lever 114 and the pawl 112 may be dispensed with and only the weighted lever 110 used to operate the indicating-lever  
35 50. The raising of the lever 110 will raise the lever 50 and the dropping of the lever 110 will allow the lever 50 to drop. I preferably employ a holding or locking lever 57, one for each cam, (see Figs. 1 and 4,) the upper end  
40 of which is adapted to enter the notches in the periphery of the cams to hold the same steady when not in motion. The lower end of said lever is provided with a spring 58, adapted to draw over the upper end of said  
45 lever and cause the same to engage with the cam. I also employ a holding-lever 59', with its upper end adapted to engage with and hold the cam-wheel points of the cam-wheel 52 and the lower end connected with the  
50 spring 58 for holding said lever in engagement with said cam-wheel. (See Fig. 1.)

Having described the mechanism for operating the cams 34, 35, 36, 37, and 38, I will now proceed to describe the mechanisms operated  
55 by said cams for, first, shifting the swivel-shuttle racks; second, changing the position longitudinally of the swivel-shuttle rail carrying the racks, and, third, lowering and raising said swivel-shuttle rail and at the same time  
60 operating the sliding pick device to cause the loom to weave the spots or figures in the fabric, or not to weave them, as desired. On a rod 60'', supported in the upright part of the stand 32, (see Figs. 1 and 2,) are hung the vertical  
65 levers 59, 60, 61, 62, and 63, one for each of the cams 34, 35, 36, 37, and 38, respectively. Each of said levers is provided with an arm

extending out therefrom, carrying a pin or roll adapted to extend into the groove in the inner face of the respective cam. The shape of said cam-groove conforms to the desired movement to be given to each of said levers. The three rear levers 59, 60, and 61 are connected at their lower ends with two sets of cords 59', 60', and 61', which pass around two sets of sheaves 67, 68, and 69, (see Fig. 1,) supported on extensions 94 on the rear or inner ends of the horizontal hinged arms 73. (See Fig. 11.) From said sheaves 67, 68, and 69 said cords pass over two sets of sheaves 70, 71, and 72, (see Figs. 1 and 11,) supported on the forward or outer ends of the two arms 73. The said arms 73 are hinged at their rear or inner ends on stand 94', secured to the rear loom-arch and extend out under the loom-arches at each end of the swivel-shuttle rail. (See Fig. 11.) To the forward or outer ends of the two swinging arms 73 are hinged the two vertical swinging arms 74. The two pairs of arms 73 and 74 form a freely-swinging frame, supported over the lay, said frame being capable of being raised and lowered and of being moved from side to side or longitudinally relatively to the lay. In the lower part of said swinging frame is supported the movable swivel-shuttle rail, carrying the swivel-shuttles to be hereinafter described. On the lower ends of the vertical arms 74 is pivotally supported by pins 66 the swivel-shuttle rail 75, carrying in this instance the three swivel-shuttle racks 76, operating the three sets of swivel-shuttles 77, only one of the swivel-shuttles being shown in Fig. 1; also, at the lower ends of the vertical arms 74 are supported the two sets of sheaves 78, 79, and 80, (see Figs. 1 and 2,) over which pass the cords 59', 60', and 61', one pair of cords for each swivel-shuttle rack, and the ends of each pair of cords are detachably connected with pins or eyes 81 in their respective swivel-shuttle rack 76. (See Fig. 1.) It will thus be seen that the swivel-shuttle racks 76, for operating the swivel-shuttles, have a positive motion in either direction through the cords 59', 60', and 61' and the levers 59, 60, and 61, operated by the cams 34, 35, and 36, respectively. To the end of the lever 62 are attached cords 62', which pass over the sheaves 82, 83, and 84, (see Figs. 1, 2, and 11,) supported alongside of the sheaves above described, to the swivel-shuttle-rail-supporting stands 85, hinged on the upper side of the hand-rail 6. (See Figs. 1, 12, and 13.) The motion of the lever 62 through the cords 62', attached to hand-rail 6, will cause the swinging arms 74 to move in one direction or the other and carry with them the swivel-shuttle rail 75 and move it to change its position longitudinally or relatively to the width of the fabric, according to the shape of the cam operating said lever 62, so as to place the spots woven by the swivel-shuttles in the different positions desired. It is to be observed that the stands 85 are, so to speak, fixtures upon the hand-rail, and that therefore when the



lever 62 is moved in one direction or the other one of the cords 62' will be so tightened up around the sheaves 82 83 84 as to cause the swinging arms 74 to move laterally of the loom in the direction of the strain. While the swivel-shuttle rail is depressed into the position which it occupies while the swivel-shuttles 77 are running, the pick mechanism must be disconnected, and this is accomplished by means of the lever 63, operated by cam 38, and the cord 63', which is connected with the said lever 63 and passes over the sheave 86, supported on a stand 95 on the loom-arch, (see Figs. 1 and 11,) and over the sheave 86' at the bottom of the loom and is connected to the collar 23 on the sliding shaft 16. The sliding pick device will thus be operated by the cord 63' and the lever 63, according to the conformation of the cam 38, which controls the operation of said lever. In arms 87, upon the top of the front loom-arch, (see Figs. 1, 2, and 11,) is supported a rocking shaft 88. On one end of said rocking shaft 88 is fast an arm 89. To the outer end of said arm 89 is attached the end of a cord 90, which passes around the sheave 91 on the stand 95, and is attached to or forms a part of the cord 63' at a point 90', (see Fig. 1,) leading from the lower end of the lever 63, as before stated; also fast on the rocking shaft 88 are the two arms 92, to the outer ends of which are attached cords 93, with their lower ends attached to the outer ends of the horizontal arms 73. Said cords 93 serve to hold the horizontal arms 73 in proper position, so that the swivel shuttle rail 75, carrying the swivel-shuttle racks 76 and swivel-shuttles 77, will be supported in its proper position above the lay 4, and when the swivel-shuttles for weaving the spots are not in use they will be raised up from the lay by means of said cords 93, arms 92, rocking shaft 88, arm 89, and cord 90, attached to the cord 63', connected with the lever 63. It will thus be seen that the lever 63 when moved in one direction operates, through the intervening mechanism above described, both the shipping devices for the fly-shuttle picking mechanism and the swivel-shuttle rail, causing the said swivel-shuttle rail to be lowered into position for the swivel-shuttles to run and the picking motion for the fly-shuttle to be disconnected, and when the said lever 63 is moved in the opposite direction the swivel-shuttle rail is raised from the lay and the picking motion is connected, so as to operate the fly-shuttle. By this construction the fly-shuttle-picking motion of the loom must be disconnected when the swivel-shuttles are in position for running, so that there can be no danger of breakage or damage from the accidental operation of the fly-shuttle.

I will now describe more particularly my improvements relating to the movable swivel-shuttle rail carrying the swivel-shuttles and the manner of attaching the same to the hand-rail. The swivel-shuttle rail 75 is supported over the lay independently of the hand-

rail 6 by means of the vertical arms 74, as above described, so that said swivel-shuttle rail 75 may be raised and lowered for moving the swivel-shuttles out of action or moving them into action, and said swivel-shuttle rail may also be moved longitudinally relatively to the hand-rail to change the position of the spots or figures by means of the cams and connections thereto above described. The swivel-shuttle rail 75 consists of the rail proper, having supported therein the three racks 76, which extend parallel to each other and which have a reciprocating longitudinal movement in slots in the swivel-shuttle rail by means of cords attached to the eyes 81, secured in said racks, as above described. The racks 76 operate three sets of pinions 97, mounted loosely on pins 98, fast in the lower part of the swivel-shuttle rail 75 in the ordinary way. (See Fig. 12.) Said pinions 97 operate the three sets of swivel-shuttles 77, extending in a vertical position in three rows, as fully shown in Fig. 12. By using two or more sets of swivel-shuttles arranged as above described for weaving each spot or figure in the fabric I am enabled to put into each spot or figure two or more different colors, according to the number of sets of swivel-shuttles used. Each set of swivel-shuttles is provided with a different color of weft, if desired. I prefer to connect the swivel-shuttle rail 75 with the hand-rail 6, so that said swivel-shuttle rail may be held against the hand-rail 6 during the operation of the swivel-shuttles by means of the two U-shaped stands 85. (See Figs. 12 and 13.) The swivel-shuttle rail 75 is adapted to move up and down and also longitudinally within the U-shaped stands 85, the sides of which act as bearings for the sides of the swivel-shuttle rail as said shuttle-rail is raised from the lay or lowered toward the lay for the swivel-shuttles to operate. The U-shaped supporting-stands 85 of the swivel-shuttle rail are preferably each hinged at their rear upper part thereof by means of a pin 99, supported in the upper part of an arm 100, rigidly secured at its base on top of the hand-rail 6. Said arm 100 is provided with projections or ears 100' 100'', and supported on the rear side of the U-shaped stand 85 is a lock-lever 101, pivoted on pin 102 in said stand. Said lever 101 is adapted to be raised to a vertical position, as shown by dotted lines, Figs. 14 and 15, to disconnect the same from the projections on the arm 100 and allow the stands 85, within which the swivel-shuttle rail 75 extends, to be freely raised or lowered on their hinged point. When the U-shaped stands 85 are lowered, as shown in Fig. 12, the lock-lever 101 is moved down in front of the upper projection 100'', as shown in Figs. 12 and 15, thus locking the stands 85 and preventing any movement of the same on their hinged point. When the stands 85 are raised up, the locking-lever 101 is moved down under the projection 100' of the arm 100, as shown in Fig. 13, thus locking the stands having



the swivel-shuttle rail 75 supported therein in their raised position. The object of having the stands 85, within which the swivel-shuttle rail 75 extends, hinged to the hand-rail 6 is to allow of the swivel-shuttle rail 75 being tilted or raised up so as to readily get at the bobbins in the swivel-shuttles, and the object of the locking mechanism is to rigidly support and lock the swivel-shuttle rail and swivel-shuttles in their normal position extending alongside of the hand-rail or to hold and lock them in their raised position, for the purpose above stated. When the swivel-shuttle rail 75 is raised up, as shown in Fig. 13, if it is desired to get at any one of the two inner or lower sets of swivel-shuttles to remove an empty bobbin and substitute a fresh bobbin the ends of the connections or cords 59', 60', and 61' are disconnected from the pins or eyes 81 in the swivel-shuttle racks, and then the swivel-shuttle racks are moved by hand, so that the swivel-shuttles to be gotten at will be moved into the warp or open space in said rail, as shown in Fig. 1, allowing free access to the bobbin in the swivel-shuttle and the ready removal of the same and the substitution of a fresh bobbin. Upon the top side of the swivel-shuttle rail 75 are secured in this instance two bent arms 107, with their projecting ends 107' adapted to rest on the hand-rail 6, as shown in Fig. 2, to support the swivel-shuttle rail 75 and limit the downward motion thereof.

Referring to Fig. 18, the stand 85', within which the swivel-shuttle rail 75' extends, is rigidly connected with the hand-rail 6' for the reason that the swivel-shuttle extends in a horizontal plane, and therefore it is not necessary to tilt up the shuttle-rail to get at the bobbin in the swivel-shuttle.

In Fig. 17 I have shown a modification of the cam-lever shown in Fig. 1. I provide a second lever 103, pivoted on the stand 32 and provided with a longitudinal slot 104 therein. A connector 105 extends from the lower end of the cam-lever 63 to the slot 104 in the lever 103. Said lever is adjusted up and down in said slot and retained in place by means of a screw (not shown) to vary the travel or amount of motion of said lever 103, to the lower end of which are attached the cords leading over the sheaves to operate the racks or to move the swivel-shuttle rail longitudinally. It will thus be seen that without changing the shape of the cam I can vary the amount of travel of the lever 103 and the connections thereto.

From the above description, in connection with the drawings, the operation of my improved swivel-shuttle mechanism will be readily understood by those skilled in the art.

The advantages of my improved swivel-shuttle mechanism will be readily appreciated by those skilled in the art. I provide one or more sets of swivel-shuttles, arranged in lines parallel to each other, extending over the

race, all of which are operated automatically and each set independently. I am thus enabled to put into each spot or figure in the fabric one or more different colors, according to the number of sets of swivel-shuttles used.

It will be understood that the details of construction of the several parts of my improvements may be varied from what is shown and described, if desired.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a swivel-rail, fly-shuttle-actuating mechanism, and shipping devices for rendering such actuating mechanism operative and inoperative, as required, of a lever, connections between the said lever and the said swivel-rail, and shipping devices whereby the rail may be moved into and out of working position simultaneously with the actuation of the shipping devices, a cam acting upon the said lever, means for actuating the said cam, and devices for controlling such actuation of the cam, substantially as described.

2. The combination, with the fly-shuttle-actuating mechanism and shipping devices for rendering such mechanism operative and inoperative, as required, of automatic devices for actuating such shipping devices, comprising a lever in operative connection with the said shipping devices, a cam acting upon the said lever, a pawl for moving said cam, and means for operating the pawl, substantially as described.

3. The combination, with a swivel-rail, a lever having operative connections with the said rail, whereby to move the latter in the direction of its length, a second lever, a connection between the two levers which is adjustable to vary the throw communicated to the lever first mentioned, a cam acting upon the second lever, a pawl operating said cam, and a crank operating said pawl, substantially as described.

4. The combination, with a cam having in its periphery notches formed with contracted open ends, of a pawl, a crank operating said pawl, and a rod or pin supporting said pawl and acting in conjunction therewith, substantially as and for the purposes set forth.

5. The combination, with the swivel-racks and levers in operative connection therewith, of a series of cams engaging with the said levers, pawls operating the said cams, indicating-levers controlling the action of the pawls on the cams, and a crank operating the pawls, substantially as described.

6. The combination, with the swivel-rail, a frame supporting the same, and the lay, of means for automatically swinging the frame and changing the position of the swivel-rail longitudinally thereof, such means consisting of a cam, an operating-pawl, means for actuating said pawl, a lever acted on by the cam, and flexible connections extending from



said lever around sheaves on the frame and connected to the lay, substantially as described.

7. The combination, with the lay, guides carried thereby, and a swivel-rail, of a supporting-frame pivoted to the loom-frame and by which the swivel-rail is suspended, a cam, actuating devices for the said cam, controlling devices whereby the time of movement of the cam is determined, a lever operated by the said cam, and connections from the lever to the pivoted frame for swinging the latter to move the swivel-rail into and out of working position, substantially as described.

8. The combination, with the lay, guides carried thereby, a swivel-rail, and a supporting-frame above the lay with which the swivel-rail is connected, of means for raising and lowering the said frame and the swivel-rail, consisting of a cam, an operating-pawl, devices for actuating the said pawl, a lever acted upon by the cam, a rocking shaft, connections from the lever to the shaft, whereby the said shaft may be rocked, and connections from the shaft to the frame, whereby the latter and swivel-rail may be raised and lowered, substantially as described.

9. The combination, with the lay, guides carried thereby, and a swivel-rail, of a supporting-frame pivoted to the loom-frame and by which the swivel-rail is suspended, a lever and operative connections between the same and the supporting-frame for moving the latter to place the swivel-rail in and out of working position, a second lever and operative connections between the same and the supporting-frame for moving the latter to shift the swivel-rail in the direction of the length thereof, cams acting on the said levers, actuating devices for the said cams, and controlling devices whereby the time of movement of the cams is determined, substantially as described.

10. The combination, with a swivel-rail, two or more series of swivel-shuttles, two or more series of pinions for engaging with the said shuttles, and two or more racks in engagement with the said pinions, of two or more levers, connections between the said levers and racks, whereby the latter may be actuated as the levers are moved, a series of cams acting to move the said levers, means for moving the respective cams, and devices whereby the actuation of the said cams by the said means is controlled in accordance with the requirements of a pattern, substantially as described.

11. The combination, with a swivel-rail, a supporting-frame therefor, two or more series of swivel-shuttles, two or more series of pinions engaging with the said shuttles, and two or more racks in engagement with the said pinions, of a series of levers, operative connections between one of the said levers and the supporting-frame, whereby the said frame

and the swivel-rail are raised and lowered as the said lever is moved, connections intermediate certain of the said levers and the racks, whereby the said racks are operated as the said levers are moved, a series of cams acting upon the series of levers, means for moving the respective cams, and devices whereby the actuation of the said cams by the said means is controlled in accordance with the requirements of a pattern, substantially as described.

12. The combination, with a swivel-rail, a supporting-frame therefor, two or more series of swivel-shuttles, two or more series of pinions engaging with the said shuttles, and two or more racks in engagement with the said pinions, of a series of levers, operative connections between one of the said levers and the supporting-frame, whereby said frame and the swivel-rail are raised and lowered as the said lever is moved, connections intermediate certain of said levers and the racks, whereby the said racks are operated as such levers are moved, and connections with another one of the said levers, whereby the swivel-rail is moved in the direction of its length as the said lever last mentioned is moved, a series of cams acting upon the series of levers, means for moving the respective cams, and devices whereby the actuation of the said cams by the said means is controlled in accordance with the requirements of a pattern, substantially as described.

13. The combination, with the swivel-shuttles, a series of levers, and devices intermediate the said shuttles and the levers, whereby the shuttles are brought into action when the said levers are actuated, of cams for moving the levers, pawls for moving the cams, means for operating the pawls, and indicating mechanism controlling the action of the pawls, such indicating mechanism consisting of a series of indicating-levers, one for each cam and operating-pawl, and mechanism for operating said indicating-levers, the action of the latter mechanism controlled by Jacquard or harness cords, substantially as set forth.

14. The indicating mechanism consisting of a series of indicating-levers, each provided with a cam-surface, in combination with a series of weighted levers, each provided with a cam-surface to engage the cam-surface on the corresponding indicating-lever, the said weighted lever operated by a Jacquard or harness cord to engage and raise said indicating-lever, a pawl for engaging said weighted lever to hold the same in engagement with the indicating-lever, and a second weighted lever operated by a Jacquard or harness cord to trip the pawl and release the indicating-lever, substantially as set forth.

GEORGE F. HUTCHINS.

Witnesses:

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